AD NUMBER

AD834919

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; MAR 1968. Other requests shall be referred to Air Force Materials Lab., Attn: MAAM, Wright-Patterson AFB, OH 45433.

AUTHORITY

Air Force Materials Lab ltr dtd 2 May 1972

MECHANICAL-PROPERTY DATA AFC-260 STAINLESS STEEL

Aged Sheet

Issued by

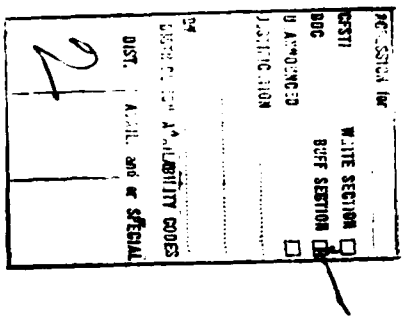
Air Force Materials Laboratory
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

March, 1968

Prepared by

Battelle Memorial Institute
Columbus Laboratories
Columbus, Ohio 43201

F33615-67-C-1292



This data sheet was prepared by Battelle Memorial Institute under Contract F33615-67-C-1292. The contract was initiated under Project No. 7381, "Materials Application", Task No. 738106, "Design Information Development". The major objectives of this program are to evaluate newly developed structural materials of potential Air Force weapons-system interest and then to provide data-sheet-type presentations of mechanical data. The program was assigned to the Structural Materials Engineering Division at Battelle under the supervision of Mr. Walter S. Hyler. Project engineer was Mr. Omar Deel. The program was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, by Mr. Marvin Knight, project engineer.

Notices

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

Qualified requesters may obtain copies of this data sheet from the Defense Document Center, Washington, D. C.

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with the prior approval of the Materials Application Division (MAAM), AFML, Wright-Patterson Air Force Base, Ohio.

AFC-260

AFC-260 is a semiaustentic precipitation-hardenable stainless steel recently developed by the Crucible Steel Company under Air Force Contract AF 33(615)-2201. The composition is balanced so that it can be heat treated to an austenitic structure suitable for cold or warm deformation. With additional thermal treatments, AFC-260 can be transformed to martensite and then age hardened to high strength levels.

Preliminary data show that the new AFC-260 retains its strength well upon prolonged exposure to elevated temperatures, that its oxidation resistance is comparable to that of currently available semiaustenitic stainless steels, and that it can be satisfactorily welded with the resulting welds exhibiting a high degree of strength efficiency.

The nominal composition of AFC-260 is as follows:

C	Cr	Ni	Mo	Co	Cb	N	Fe
0.07	15.5	1.85	4.5	13.0	0.15	0.03	Bal.

The heat treatment (designated 19RA by Crucible) used for this test program is as follows:

Solution anneal at 1900 F and air cool,
Refrigerate at -100 F for 8 hours,
Age at 1000 F for 2+2 hours.

AFC-260 is presently available in sheet and bar form.

BLANK PAGE

AFC-260 Data[a]

Condition: Aged
Thickness: 0.060-Inch Sheet

Properties	Temperature, F			
	RT	500	700	900
Tension				
F_{tu} (longitudinal), ksi	254.0	220.0	215.0	201.0
F_{tu} (transverse), ksi	253.0	220.0	215.7	203.3
F_{ty} (longitudinal), ksi	205.7	176.7	161.3	140.0
F_{ty} (transverse), ksi	201.3	176.7	160.0	145.3
e_t (longitudinal), percent in 2 in.	10.3	6.0	5.7	7.8
e_t (transverse), percent in 2 in.	10.3	6.0	5.8	8.2
E_t (longitudinal), 10^6 psi	27.7	26.4	26.6	26.2
E_t (transverse), 10^6 psi	27.0	25.1	26.3	24.8
Compression				
F_{cy} (longitudinal), ksi	253.3	218.0	207.7	196.0
F_{cy} (transverse), ksi	231.7	204.7	188.7	169.7
E_c (longitudinal), 10^6 psi	31.2	30.5	29.4	27.8
E_c (transverse), 10^6 psi	29.9	29.0	28.0	26.8
Shear[b]				
F_{su} (longitudinal), ksi	162.8	U	U	U
F_{su} (transverse), ksi	161.5	U	U	U
Impact (V-notch Charpy)	U[c]	U	U	U
Fracture Toughness, K_{Ic}, ksi $\sqrt{in.}$	~60[d]	U	U	U

Properties	Temperature, F			
	RT	500	700	900
Axial Fatigue (transverse)[e]				
Unnotched, R = 0.1				
10^3 cycles, ksi	245	234	U	210
10^5 cycles, ksi	171	138	U	136
10^7 cycles, ksi	141	126	U	110
Notched (K_t = 3.0), R = 0.1				
10^3 cycles, ksi	165	150	U	120
10^5 cycles, ksi	60	54	U	51
10^7 cycles, ksi	39	39	U	50

	Temperature, F			
	RT	800	900	950
Creep (transverse)				
0.2% plastic deformation 100 hr, ksi	NA	NA	113	70
0.2% plastic deformation 1000 hr, ksi	NA	NA	98	46
Stress Rupture (transverse)				
Rupture 100 hr, ksi	NA	NA	175	150
Rupture 1000 hr, ksi	NA	NA	162	120
Stress Corrosion				
80% F_{ty}, 1000 hr max	Failed[f]	U	U	U

Coefficient of Thermal Expansion[g]

5.87×10^{-6} in./in./F (77-600 F)

Density[g] 0.282 lb/in.^{3}

Footnotes appear on the following page.

FOOTNOTES FOR AFC-260 DATA

(a) Data are average of triplicate tests conducted at Battelle under the subject contract unless otherwise indicated. Fatigue, creep, and stress-rupture values are from curves generated using a greater number of tests.

(b) Single-shear sheet type specimen, full thickness.

(c) U, unavailable; NA, not applicable.

(d) Value from Reference (1). A conditional value determined on 3-point loaded notched slow-bend specimens where W = 1.2, B = 0.6, and a_o = 0.6. The

The tests at Battelle were on single-edge-notched (3 x 12 in.) tension type specimens. No pop-in was detected. Load-strain curves were analyzed by the secant modulus method in ASTM STP 410 and proved to be invalid K_{Ic} tests (material too thin).

(e) "R" represents the algebraic ratio of the minimum to the maximum stress in one cycle; that is, $R = S_{min}/S_{max}$. "K_t" represents the Neuber-Peterson theoretical stress-concentration factor.

(f) Three-point bend test. Alternate immersion in 3-1/2 percent NaCl.

Specimen Number	Time, days cracking appeared (20X)	Time, days to fracture
7-1	29	37
7-2	21	28
7-3	22	26-28
7-4	38	46-50
7-5	22	30

(g) Values from References (2) and (3).

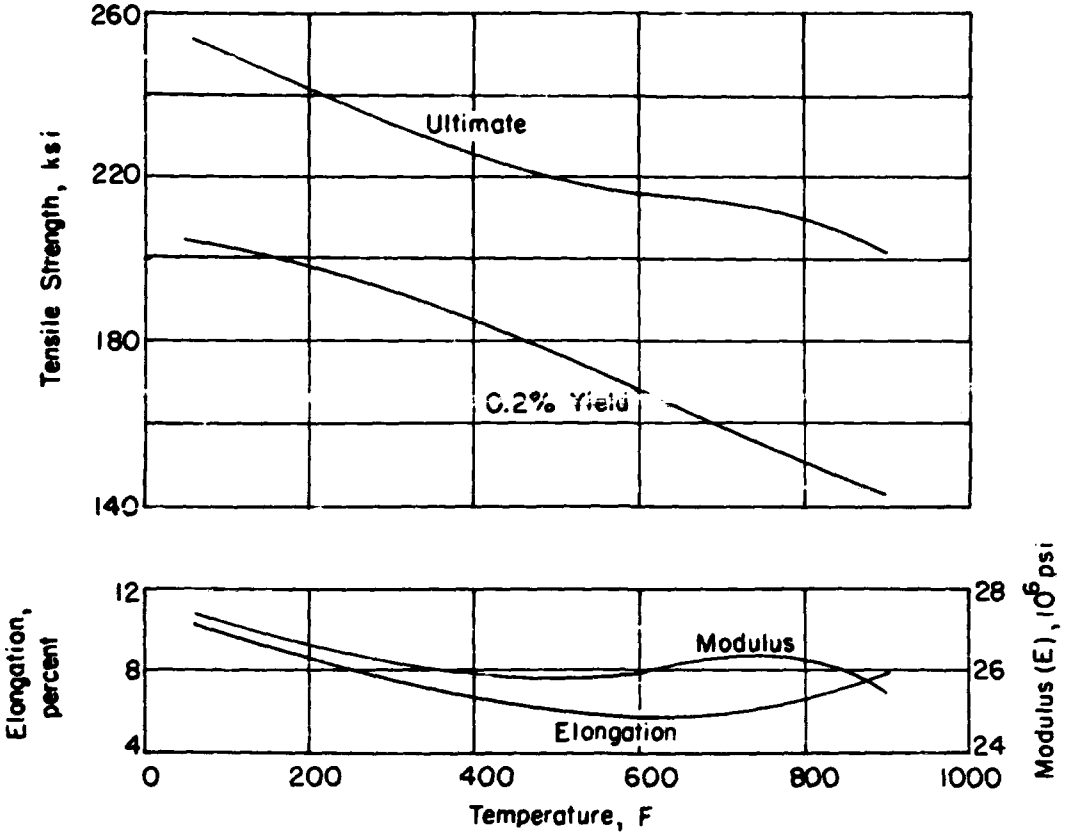


FIGURE 1. EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF AFC-260 STAINLESS STEEL SHEET

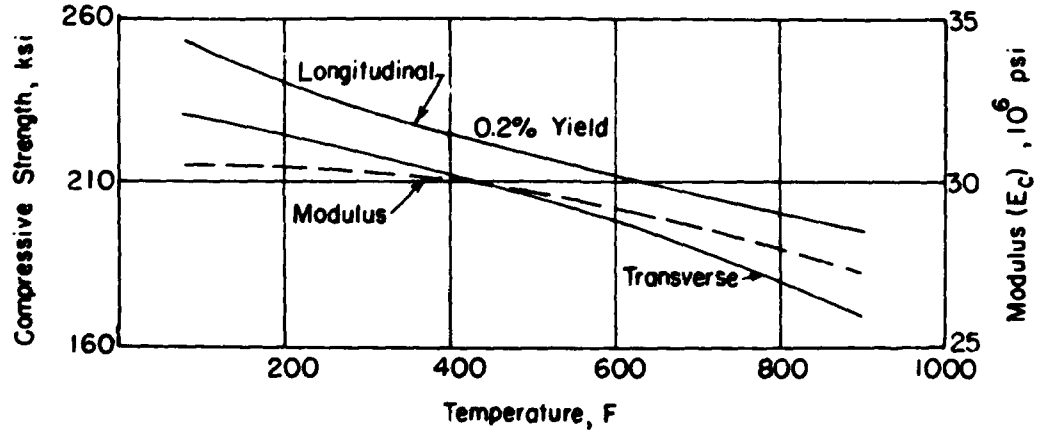


FIGURE 2. EFFECT OF TEMPERATURE ON THE COMPRESSION PROPERTIES AFC-260 STAINLESS STEEL SHEET

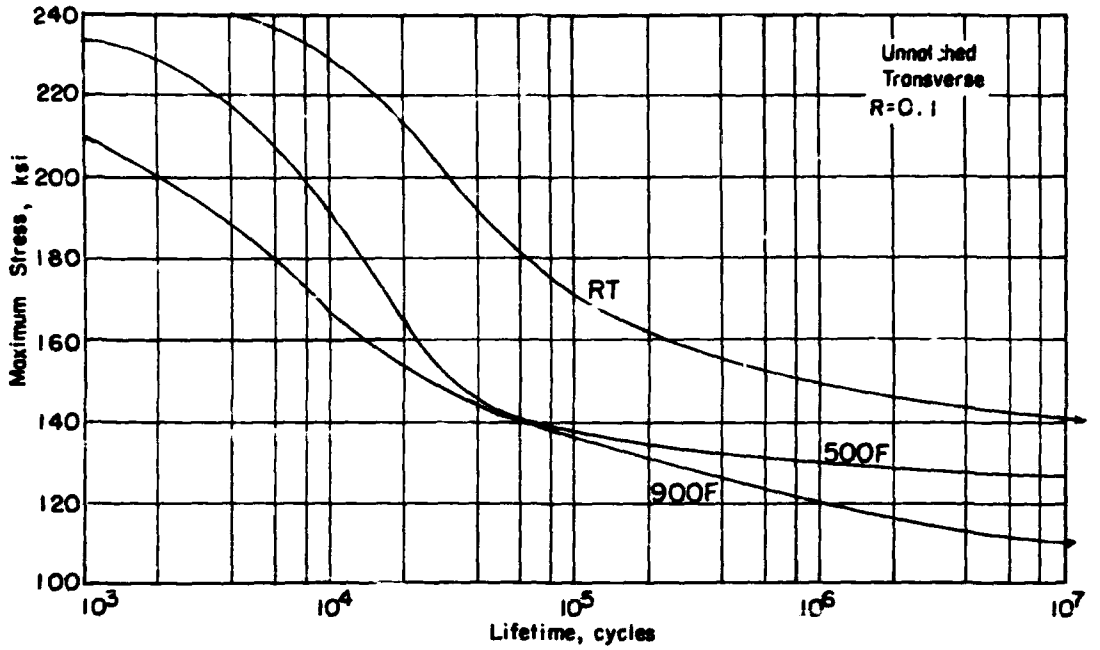


FIGURE 3. AXIAL-LOAD FATIGUE RESULTS FOR UNNOTCHED AFC-260 STAINLESS STEEL SHEET AT THREE TEMPERATURES

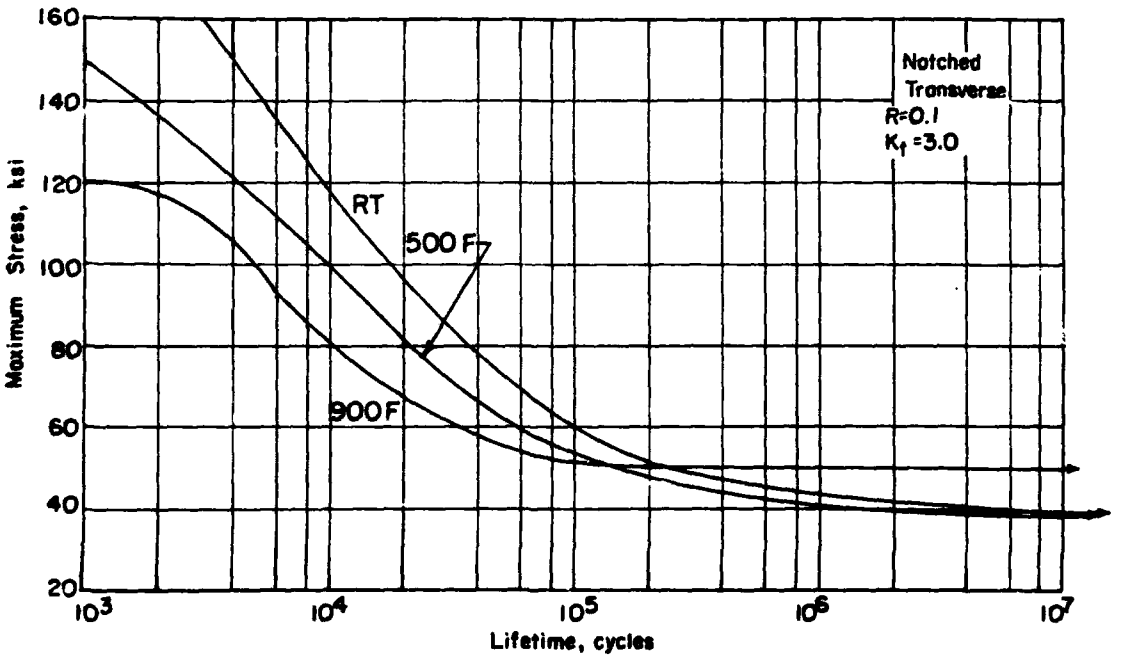


FIGURE 4. AXIAL-LOAD FATIGUE RESULTS FOR NOTCHED (K_t =3.0) AFC-260 STAINLESS STEEL SHEET AT THREE TEMPERATURES

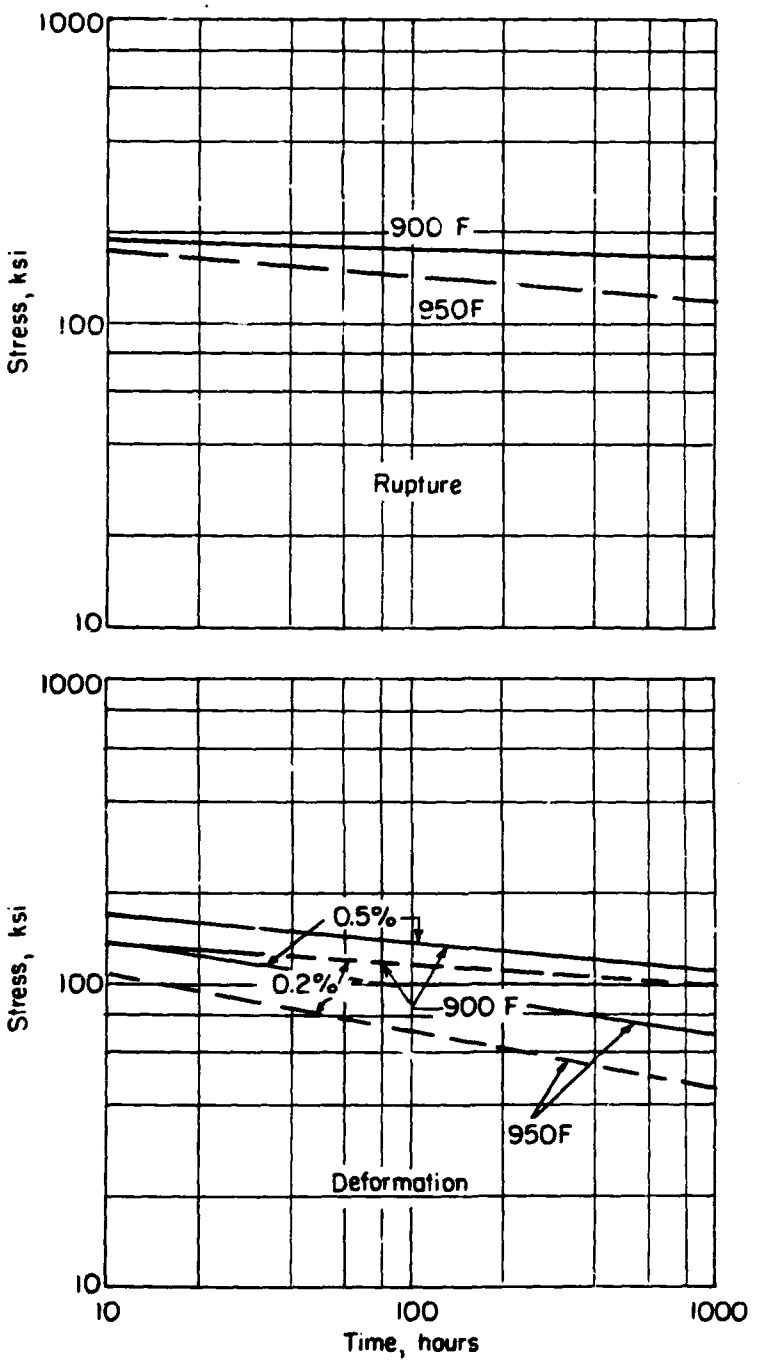


FIGURE 5. STRESS-RUPTURE AND PLASTIC DEFORMATION CURVES FOR AFC-260 SHEET AT TWO TEMPERATURES

REFERENCES

(1) Moll, J. H., Stasko, W., and Kozak, A., "Development of a New High-Strength Semiaustenitic Precipitation-Hardenable Stainless Steel", AFML-TR-67-286, Crucible Steel Company, September, 1967.

(2) Private communication with Mr. J. H. Moll, Crucible Steel Company.

(3) Private communication with Mr. R. Shiring, Crucible Steel Company.